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Contract Report for 10/2019

1. Project Title: Artificial Intelligence for Tactical Logistics

2. Performer: Penn State University-Applied Research Lab

3. Contract or Grant (if applicable): N00014-19-PR-00047

4. Principal Investigator Name: Robert Walter, rlw9@arl.psu.edu, o 814-571-2488, (b)(6) [redacted]

5. Future Major Project Milestones: (Deliverables, Tests, Experiments, etc.)

Milestone Title	Description / Impact	Date
Task 1 - Add Log to BKA	• Semantically enrich the logistics messages passed on the TSOA by annotating the schemas with ontological representations. • Create logistics models in the BKA that will be reported in each of the tactical logistics reports and mapped back into the event timeline (b)(4) [redacted] • Extend user interfaces to include logistics information. • Provide demonstrations to and exercises with the MCSC and MCWL. (b)(4) [redacted]	12/31/2019
Task 2 – Analyze Tactical Logistics Planning Needs	• Analyze the tactical logistics planning requirements for supporting the Autonomous Aerial Resupply (AAR) initiative. • Identify requirements which could feasibly be met by AI techniques and identify preliminary techniques. • Identify data elements required to support AI algorithm development and operational use. • Assess feasibility and expected impacts and select best candidates for prototype development in Task 3.	3/31/2020
Task 3 – Develop Logistics Planning Services	• Define and develop planning services to understand tactical logistics demands, where supplies and delivery capabilities are located, and how to effectively deliver and match capabilities to prioritized tactical needs. • Apply AI techniques identified in Task 2 to develop AI models which meet the identified planning	12/31/2021

	requirements using data provided by the BKA and implement within planning services. • Develop optimization models to execute operational, dynamic supply and demand matching and asset tasking. • Develop an operational simulation that generates and publishes logistics status messages to the TSOA used to evaluate the operational effectiveness of dynamic logistics planning. • Develop a user interface to integrate capabilities.	
Task 4 – Develop Logistics Planning and Analytical Interface	• Define and develop a logistics planning and analytical interface between the TSOA and Agile Cloud Services (ACS) or Tactical Cloud Reference Implementation (TCRI) afloat in order to leverage a distributed planning and analytic capability.	3/31/2021
Task 5 – Assess Distributed Logistics Ledger and Distributed Applications	• Assess use cases for applying distributed logistics ledger and distributed applications (Dapps) using blockchain smart contracts that operate in a disconnected, intermittent and low bandwidth (DIL) environment and operate when disconnected from enterprise resource planning (ERP) systems. Use red-cell techniques to assess cybersecurity strengths and weaknesses.	3/31/2020

6. Reporting Period Narrative: (Description of research performed focusing on the technology or new discovery; make particular mention to the research challenges/issues; publications/theses, etc.)

Task 1 – Met with logistics SME and the developers of ARL's prototyped logistics application suite to identify further sources of logistics information available over the SOI. Pending future development (from prototype to product), the logistics information provided by the application suite will be limited. Task focus will be shifting away from ontology development and toward an examination of the Joint Deployment Logistics Model (JDLM) simulator, for use in ASF.

Task 2 – Reviewed the EAB operational scenario with USMC Fellow at PSU. Received direction from the sponsor to integrate JDLM with the Advanced Simulation Framework (ASF) and revised the tasking for our team accordingly. Received map tiles for the area of operation. The objective is to control JDLM from ASF in order to generate training data for logistics algorithms.

Task 3 – None.

Task 4 – None.

Task 5 – Implemented revocation user interface and logic in Validator. Finished defining message between Validator and Permission Marshal to coordinate a revocation. Separated bloom filter logic into a module so that Validator can use the same library and logic as Permission Marshall. Added ability to listen to

ActiveMQ for bloom filter files sent from the relay. Provide a way to issue root attributes in the genesis block. Integration testing between Permission Marshall and Validator.

7. Risk: (All projects have risks associated with cost (potential for overruns), schedule (slippage), and technical performance)

No.	Explain Risk & Impact if Realized	Mitigation Strategy	Change from Previous (New, Increasing, Decreasing, Static, or Realized?)
1	Schedule: None		
2	Performance: None		
3	Technical: We are not yet certain how we will generate AI training data. Integrating JDLM with ASF requires commercial technologies that are quite new and might not function as advertised.	It will take about 1 more month to evaluate our simulation options.	Static
4	Cost: None		
5	Performance: None		

8. Additional notes to program manager: (No change from last month.) (b)(4) [redacted]

9. Optional Graphics.